

including between about 55% and about 75% iron and between about 25% and about 45% cobalt, said percentages being by weight, based on the total weight of the alloy.

REMARKS

All the claims examined on the merits in this application have been rejected on two substantive grounds. Applicants have amended their claims and respectfully submit that all the claims currently in this application are patentable over the rejection of record.

The first substantive ground of rejection is directed to all the claims examined on the merits in this application, Claims 1-10, which stand rejected, under 35 U.S.C. §102(b), as anticipated by or, in the alternative, under 35 U.S.C. §103(a), as obvious over U.S. Patent 4,933,026 to Rawlings et al.

The Official Action avers that Rawlings et al. teaches specific examples of alloys whose compositions encompass the alloy composition recited in the instant claims. In support of this allegation, the Official Action points to the fourth and tenth alloy set forth in Table 1, bridging Columns 1 and 2. Furthermore, the Official Action notes that alloys 4 and 10 have saturation magnetization values of 2.45 and 2.44 Tesla, respectively. The Official Action notes that these saturation magnetization values are within the scope of those claimed in the present application.

Applicants have amended their claims and respectfully submit that, as amended, the claims currently in this application are patentable, under 35 U.S.C. §102(b), or, in the alternative, under 35 U.S.C. §103(a), over Rawlings et al.

Applicants have amended the broadest claim currently in this application, Claim 1, to recite that the cobalt constituent is present in a concentration of between about 25% and about 45% by weight, based on the total weight of the composition.

Support for this amendment is present in the specification of the originally filed application at Page 13, line 3 wherein it is recited that the cobalt constituent is present in a concentration of between about 25% and about 45% by weight, based on the total weight of the alloy film.

Applicants submit that entrance of the instant amendment of the broadest claim of the present application is appropriate given that the amendment more specifically defines the invention of the present application and better places this application in condition for allowance.

It is noted that Claim 1 has additionally been amended to add the word --thin-- in the preamble and characterizing portions of the claim in describing the cobalt-iron alloy film. Normally, such a designation would be deemed indefinite. However, in the ambit of cobalt-iron films this term has a definitive and well known meaning.

Applicants submit herewith Page 2208 of the Academic Press Dictionary of Science and Technology, edited by Christopher Morris, wherein the term "thin film" is defined in electronic applications as a thin layer, generally less than one micron, of an insulating, conducting or semiconducting material that is deposited successively on a supporting substrate. It is noted that the definition indicates that the deposition is performed by mechanical, chemical or high vacuum evaporation methods.

A second definition of a thin film is provided in Van Nostrand's Scientific Encyclopedia, Seventh Edition at Page 2818. Therein the term "thin films" is elaborately

defined. That definition establishes that a thin film is used to describe a wide variety of physical structures. That definition states that when self-supporting sheets are thinned from thicker material, by such methods as rolling, beading or etching, they are denoted as foils. Films are stated to be the product obtained by stripping a deposited layer from a substrate. Supported thin films are deposited on planer, or (in special cases) curved substrates by such methods as vacuum evaporation, cathode sputtering, electroplating, electroless plating, spraying and various chemical surface reactions in a controlled atmosphere or electrolyte. Thicknesses of such supported films range from less than an atomic monolayer to a few micrometers, e.g. microns.

Yet a third definition of thin films is provided in Volume 1, Issue 1 of the Journal "Thin Solid Films," published by Elsevier Publishing Company, wherein, in introducing a new bi-monthly journal "Thin Solid Films," it indicates that the term covers layers of solid material extending from those measured in atomic or molecular dimensions up to layers or multilayers several tens of microns thick. Obviously, this definition may be somewhat imprecise so as to encompass the widest possible audience for the newly published journal.

All of the aforementioned definitions are set forth in respected scientific publications, copies of which are enclosed herewith. They are provided to emphasize the clear line of distinction between a cast film, as set forth in Rawlings et al., and a thin film within the scope of the present application.

As indicated in Rawlings et al., the thickness of cast alloy films, included in Table 1 thereof, are 0.35 mm thick (Column 1, lines 51-52). It is well established that 0.35 mm is equal to 350 microns. Clearly, the above definitions of a thin film limit them to, at the very

most, several tens of microns. Without question a film having a thickness of 350 microns is outside the definition of a "thin" film.

It goes without saying that the specification of the present application provides support for the term "thin." Attention is directed to Summary of the Invention section of the specification. In the first sentence of the Summary it is stated that the film is a thin film (Page 10, lines 18-25).

If further evidence is required to establish the clear line of distinction between the thin films of the present application and a cast film of the type taught by Rawlings et al., applicants submit portions of the text, "Ferromagnetism," by Richard Bozorth, Fourth Printing, D. Van Nostrand Company, Inc. (1956).

Attention is directed initially to Page 21 thereof. That page includes Fig. 2-10 which shows a furnace design for melting alloys weighing 10 to 50 lbs and casting, by tilting the furnace, under controlled atmosphere. Page 23 of that text describes special techniques necessary for melting alloys in a vacuum. As set forth therein, an ingot is first heated to high temperature and thereupon melted on a rolling mill. The thickness is therein decreased as is its temperature. When the thickness is decreased to 0.2-0.5 in., which is equivalent to 0.79 mm – 1.97 mm, the material is usually cooled below the recrystallization temperature (see Page 25).

The above elaborate discussion is provided to establish that the cast film product of hot rolling of a cast alloy is far removed from a thin film. As defined in Van Nostrand's Scientific Encyclopedia, a thin film has a thickness no greater than 10^{-4} cm (1 micron). The casting of a 1 micron film, which is not visible to the human eye, is substantially impossible. Indeed, the teaching of Rawlings et al. concedes that the thickness of the film of that

disclosure is 350 microns or 350 times as thick as a "thin" film, within the scope of the present application.

If yet another reference is necessary to establish the clear line of distinction between the claimed thin film of the present application and the cast film taught by Rawlings et al., applicants submit herewith The Properties of Electrodeposited Metals and Alloys, Second Ed., Safranek, Ed., American Electroplaters and Surface Finishers Society, Orlando, FL, at Page 1. The first paragraph of that text states that properties of electrodeposited metals differ appreciably from castings, forgings or rolled sheet. Clearly, Rawlings et al. teaches a cobalt-iron alloy casting.

In summary, it is impossible to cast and roll a film of 1 micron. Moreover, the film taught by the Rawlings et al. process, having thickness of 350 microns, cannot be used in the applications to which the present application is addressed. Those skilled in the art are aware that the dimensions of magnetic thin film heads are defined using multiple steps of photoresist processes. The typical thickness of magnetic films inside a magnetic head is less than 3 microns. There are about 100 individual heads on a 5 inch wafer. Those skilled in the art are aware that the building of magnetic heads requires several steps of metal disposition. It is thus clear that the use of a cast film of the type taught in Rawlings et al. would melt away the head structure, and in particular the organic dielectric that is an integral part of it and other components.

The above remarks establish the clear line of patentable distinction between the claimed thin film of the present application and the cast film of infinitely greater thickness disclosed in Rawlings et al. Reconsideration and removal of this substantive ground of rejection is therefore deemed appropriate. Such action is respectfully urged.

The second substantive ground of rejection is again directed to Claims 1-10, all the claims examined on the merits in this application, as being anticipated, under 35 U.S.C. §102(b) or, in the alternative, under 35 U.S.C. §103(a), as being obvious over Kakuno et al., J. Electrochem. Soc., 144, No. 9, 322-326 (September 1997).

The basis for rejection over Kakuno et al. is the disclosure of Figures 2 and 3 thereof. Those figures are presumably applied for their disclosure of cobalt-iron alloys having weight ratios that encompasses the claimed range of between about 55% and about 75% iron. In addition, Kakuno et al. is applied for its disclosure of Alloys 7 to 9, summarized in Table 1. These alloys are presumably applied for their disclosure of an alloy having a molar ratio of cobalt to iron of 70 to 30.

Applicants note that the outstanding Official Action comments upon applicants' previous arguments traversing this ground of rejection. Applicants have previously established that an alloy having a molar ratio of cobalt to iron 70:30 is outside the claimed weight ratio of Claims 2 and 3. However, the Official Action takes the position that the plots of Figures 2 and 3 suffice to overcome the absence of any disclosure of specific alloys within the scope of the present invention. This conclusion, applicants respectfully submit, represents a misinterpretation of the curves of Figures 2 and 3 of Kakuno et al. Figures 2 and 3 represent interpolated and extrapolated data of various observation which observations are outside the range of the claimed alloys of the present application. This data does not represent reduction to practice of any film alloy within the scope of the present application.

The above remarks are provided to emphasize the absence of any disclosure in Kakuno et al. that establishes a reduction to practice of an alloy within the scope of the

present application. As such, applicants submit that the authors of that paper did not invent an alloy film of the type claimed in the instant application.

In support of this allegation applicants point out that “product” disclosed in Kakuno et al. has no utility. Indeed, applicants submit that no “film” is actually produced by Kakuno et al. Indeed, the only alleged use of the alloys, as they are spoken of in the paper, is mentioned at the termination of the article wherein it is stated, in the last paragraph at Page 3226, that the magnetic properties of these alloys in thin films and composition modulate nanostructures will be investigated elsewhere.

This statement is an admission that Kakuno et al. has not reduced any alloy film to practice. All that is disclosed in Kakuno et al. is a theoretical alloy having no utility. There is only the suggestion that utility may be obtained in later work. Such later work has not been discovered by the inventors of the present application who are well skilled in this art and are aware of technical articles and patents published in this field.

It is an ancient principle of patent law that a reference must be enabling. This principle, first enunciated by the Supreme Court, in Seymour v. Osborne, 78 U.S. (11 Wall.) 516 20 L. Ed. 33 (1870), requires that a prior publication contain a full enabling disclosure in order for it to constitute an anticipatory reference. Thus, a prior publication must contain the same information which could be derived from a prior patent. A patent, of course, requires a full disclosure of how to make and uses the invention. Kakuno et al., a technical article, fails this test.

Stated differently, applicants repeat their previously made statement that Kakuno et al. does not teach an alloy film, as set forth in the claims, but rather teaches an alloy on a copper substrate. Applicants submit that the disclosure of an alloy, deposited on a substrate, is not

It is true that the second paragraph of "Experimental," on Page 3222, describes the plating chemical constituency. Those skilled in the art appreciate that the chemical nature of the plating bath gives hints of the magnetic properties of resultant CoFe films. Those films were plated in a CoFe bath with cobalt sulfate, as the cobalt source, and iron ammoniac-sulfate as the ferrous source. It is mentioned therein that deaeration of the electrolyte solutions was not performed. Furthermore, it is stated that the bath was prepared "without presence of additives."

Those skilled in the art are aware that CoFe films plated in an additive-free bath has high oxygen content which prevents the magnetic moment of the films to reach higher than 2.2 Tesla. This is because an additive prevents oxygen from incorporation into an alloy film during deposition. If no additive is employed, and no deaeration is performed during plating, oxygen continues to dissolve in the plating solution and be incorporated into the film. Neither cobalt oxides, iron oxides nor any combination thereof have magnetic moments remotely close to those of the unoxidized alloys.

Although the method is not part of the claims of this application, it is one of the advances of the present invention to provide an innovative way to prevent oxidation during plating of the CoFe film. Suffice it to say, the high magnetic moment of at least 2.30 Tesla, a limitation of the broadest claim of this application, has been achieved. It is clear that the experimental evidence adduced in Kakuno et al. clearly establishes that that property, included in the broadest claim of the present application, is outside the scope of the applied Kakuno et al. reference.

The above remarks are supported by evidence, which applicants submit herewith. That evidence is another technical article presented by several of the inventors of the present

application at the Electrochemical Society Spring Meeting of March 2001. That paper, "Experimental Studies on Electrodeposition of CoFe Alloys," studied the oxygen content of plated CoFe films in an additive free bath. That study employed ferrous sulfate and cobalt sulfate in which boric acid was introduced into the bath as a buffer to control surface pH on the CoFe film during plating. That study evidences no dramatic increase in surface pH during plating.

While Kakuno et al. used a poorly defined system, a bath without any buffer, those skilled in the art are aware that surface pH of the Kakuno et al. CoFe alloy deposit would be expected to increase dramatically. This is so insofar as those skilled in the art are aware that when surface pH increases, the ferrous +2 state tends to oxidize to form the ferric +3 state, which forms insoluble oxides. Thus, instead of depositing a metal, a metal oxide, e.g. iron oxide, is formed. Indeed, the aforementioned paper reported an oxygen content of 7 to 10 atomic % when plated at a pH of 2.86. On the other hand, when the pH was reduced to 2.6, a much lower oxygen content of 3.5 atomic % was obtained. The conclusion of that paper is that even an oxygen incorporation in the film of as low as 3.5 atomic % reduces the maximum magnetic moment obtainable to a range of 2.0 to 2.1 Tesla.

The above remarks are presented for the purpose of establishing that in order to determine whether films of the same composition possess the same magnetic and physical properties, an allegation made in the outstanding Official Action, one needs to investigate film impurity, especially oxygen content in a cobalt-iron film, insofar as oxygen content in CoFe films has been found to be one of the most important factors influencing magnetic moment, coercivity, resistivity and stress. Certainly, the Kakuno et al. technical article does not address this factor. Applicants strongly aver that even if Kakuno et al. produced a "film"

within the same concentration range as that claimed herein, which applicants submit is not the case, that film clearly does not possesses the same physical properties set forth in the claims of the present application.

Of course, the above remarks assume that Kakuno et al. teaches a film. Applicants submit that what Kakuno et al. teaches is a deposit of an alloy on a substrate. Unlike the claims of the present application, the Kakuno et al. paper teaches depositions of Co-Fe alloys. No where in the Kakuno et al. is the term "alloy film" used. What is disclosed in Kakuno et al. are electrodepositions of alloy materials on a substrate which is not evidenced by physical properties or any other indicia of proof of reduction to practice. Such a product is certainly not anticipatory of the claimed cobalt-iron film of the present application nor does it make such a film obvious.

The above amendment and remarks, when taken with the newly submitted documentation, establish the patentable nature of all the claims currently in this application. Notice of Allowance and passage to issue of these claims, Claims 1-10, is therefore respectfully solicited.

Respectfully submitted,



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APPENDIX

AMENDMENT SHOWING CHANGES MADE TO APPLICATION

Claim 1 (Amended): A cobalt-iron film comprising a cobalt-iron alloy thin film having a saturation magnetization of at least about 2.30 Tesla, said thin film including between about 55% and about 75% iron and between about 25% and about 45% [the remainder cobalt], said percentages [percentage] being by weight, based on the total weight of the alloy.